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EFFECT OF DIFFERENT LEVELS OF SULPHUR, NITROGEN AND SPACING ON PLANT GROWTH OF GERMAN CHAMOMILE (*MATRICARIA CHAMOMILLA* L.)

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ABSTRACT

The present investigation entitled "Plant growth, flower yield and oil percentage in seeds of german chamomile (Matricaria chamomilla L.) as by levels of sulphur, nitrogen and spacing" was carried out during 2011-2012 and 2012-2013 in the research field, Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture Technology and Sciences,(Deemed to be University) (Formerly Allahabad Agriculture Institute). The experiment consisting of 27 treatment with levels of nitrogen (150kg/ha, 180kg/ha and 210kg/ha), Sulphur (20kg/ha, 40kg/ha and 60kg/ha) and three spacing (20cm, 30cm and 40cm) was conducted in a factorial randomized block design 3x3x3. The observations recorded on various parameters of plant growth, that the application $T_{27}N_3$=210kg/ha+S_3=60kg/ha+Sp_3=40cm showed significant response in increasing that all plant growth.

KEYWORDS: Sulphur, Nitrogen .Spacing, Plant Growth, German Chamomile

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Original Article

INTRODUCTION

Chamomile is one of the most important remedies and one of the most widely used medicinal plants in Europe, Middle East, North America, Australia and Africa. Due to its growing usage of its essential oil in the pharmaceutical industry, cosmetics, perfumes and food flavoring preparations **Srivastava *et al.* (2006)**. The chamomile plant makes nerves and sexual ability strong. It is a brain tonic, diuretic, increases the menstruation of woman and milk secretion in lactating mothers, reliefs headaches and migraines and releases bladder stones. Chamomile tea is drunk to relieve muscle aches. Chewing chamomile flowers is used to heal mouth ulcers **Sarris *et al.* (2011)**. The use of chamomile as cosmetic has a history as old as the use of medicinal herbs. Its properties are particularly useful for the fragile and sensitive skin to climate change. Chamomile flavonoids moist and soften the skin. German chamomile flowers contain 0.24- to 2.0-percent volatile oil that is blue in color. The two key constituents, (-)-alpha-bisabolol and chamazulene, account for 50-65 percent of total volatile oil content. This research aimed to develop an agronomic package that could be adopted by farmers who want to grow Chamomile. The specific objective was to determine most suitable combination of Nitrogen and sulphur doses with spacing of plants.

MATERIALS AND METHODS

A field experiment entitled "Effect of different levels of sulphur, nitrogen and spacing on plant growth of German chamomile (*Matricaria chamomilla* L.)**"** under the agro climatic conditions of Northern India was conducted at Department of Horticulture, Allahabad school of Agricultural Sam Higginbottom Institute of

Agriculture, Technology and Sciences, (Deemed –to –be University), Allahabad. The experiment was carried out during Sep. 2011 to March 2012. According to treatment combination and replication the well-prepared land was divided into three blocks. Every block had 27 plots of 1.0 x 1.0 m size. The experimental block was provided with two sub irrigation channels. The experiment consisting of 27 treatment with levels of nitrogen (150kg/ha, 180kg/ha and 210kg/ha), Sulphur (20kg/ha, 40kg/ha and 60kg/ha) and three spacing (20cm, 30cm and 40cm) was conducted in a factorial randomized block design 3x3x3. Observations were recorded on three randomly selected plants of each treatment to assess the effect of treatments on growth parameters.

RESULTS AND DISCUSSIONS

Effect of Different Levels of Sulphur, Nitrogen and Spacing on Plant Height (cm), Plant Spread (cm) and Number of Branches per Plant, of Chamomile (*Matricaria chamomilla* l.)

The cursory glance over the data presented in table 1 revealed that sulphur, nitrogen and spacing application significantly influenced the plant height of chamomile at flower bud initiation stage. The plant height increased significantly with increased in level of nitrogen plant height (83.08cm) N_3 210kg/ha. It is apparent from the table 1 that the plant height increased significantly with increased in level of sulphur plant height (78.95) S_3 60kg/ha. The plant height increased significantly with increased in level of spacing plant height (78.74) Sp_3 40cm.

The sulphur, nitrogen and spacing application significantly influenced the plant spread of chamomile at flower bud initiation stage. The plant spread increased significantly with increased in level of nitrogen plant spread (54.13cm) N3 210kg/ha. The plant spread increased significantly with increased in level of sulphur plant spread(49.43) S_3 60kg/ha. The plant spread increased significantly with increased in level of spacing plant spread (49.56) Sp_3 40cm.

The sulphur, nitrogen and spacing application significantly influenced the number of branches per plant of chamomile at flower bud initiation stage. The number of branches per plant increased significantly with increased in level of nitrogen number of branches per plant (28.82) N_3 210kg/ha. The number of branches per plant increased significantly with increased in level of sulphur number of branches per plant (29.19) S_3 60kg/ha. The number of branches per plant increased significantly with increased in level of spacing number of branches per plant (28.02) Sp_3 40cm.

Effect of Different Levels of Sulphur, Nitrogen and Spacing on Number of flower per Plant, Total Number of Flower per plot, Diameter of Flowers (cm) and Number of days Taken to Appearance, of Chamomile (*Matricaria chamomilla* l.)

The sulphur, nitrogen and spacing application significantly influenced the number of flower per plant of chamomile at flower bud initiation stage. It is apparent from the table 4 that the number of flower per plant increased significantly with increased in level of nitrogen number of flower per plant (40.46) N_3 210kg/ha. The number of flower per plant increased significantly with increased in level of sulphur number of flower per plant (38.11) S_3 60kg/ha. The number of flower per plant increased significantly with increased in level of spacing number of flower per plant (46.89) Sp_3 40cm.

The sulphur, nitrogen and spacing application significantly influenced the Total number of flower per plot of chamomile at flower bud initiation stage. The Total number of flower per plot increased significantly with increased in level of nitrogen Total number of flower per plot (475.51) N_3 210kg/ha. Total number of flower per plot increased significantly with increased in level of sulphur Total number of flower per plot (432.11) S_3 60kg/ha. Total number of flower per plot increased significantly with increased in level of spacing Total number of flower per plot(432.14) Sp_3 40cm.

The sulphur, nitrogen and spacing application significantly influenced the Diameter of flowers (cm) of chamomile at flower bud initiation stage. The Diameter of flowers (cm) increased significantly with increased in level of nitrogen Diameter of flowers (cm) (2.086) N_3 210kg/ha. The Diameter of flowers (cm) increased significantly with increased in level of sulphur Diameter of flowers (cm) (1.828) S_3 60kg/ha. The Diameter of flowers (cm) increased significantly with increased in level of spacing Diameter of flowers (cm) (1.860) Sp_3 40cm.

Different levels of sulphur, nitrogen and spacing was found significant in reducing number of days taken to appearance. The minimum number of days taken to appearance (58.741days) was observed under treatment nitrogen N_3 210kg/ha. While The minimum number of days taken to appearance (59.848days) was observed under treatment Sulphur S_3 60kg/ha. Whereas the minimum number of days taken to appearance (59.911days) was observed under treatment Spacing Sp_3 40cm and maximum number of (61.419; 60.152 and 60.111 days) taken to appearance was observed under the N_1 Nitrogen 150kg/ha; S_1 Sulphur 20kg/ha and Sp_1 spacing 20cm

Interaction Effect of Different Levels of sulphur, Nitrogen and Spacing on Plant Height (cm), Plant Spread(cm) and number of Branches per Plant of Chamomile (*Matricaria chamomilla* l.)

The plant height of german chamomile as influenced by different levels of nitrogen, sulphur and spacing treatment combination. As a result of interaction between sulphur, nitrogen and spacing different levels of treatment combination the maximum plant height (84.653) was obtained with treatment combination T_{27} N3=210kg/ha+S3=60kg/ha+Sp3=40cm followed by T_{25} N3=210kg /ha + S3=60kg/ha + Sp1= 20cm, T_{26} N3=210kg/ha+S3=60kg/ha+Sp2=30cm, T_{21} N1=150kg/ha+S3=60kg/ha+Sp3=40cm and T_{22} N2=180kg /ha + S3=60kg/ha + Sp1= 20cm and the minimum (71.450) remained with T_1N1=150kg /ha + S1=20kg/ha + Sp1= 20cm. In the present finding the application of nitrogen, spacing and sulphur showed marked effect on plant height. The maximum plant height (84.653cm) was attained with the T_{27} N3=210kg/ha+S3=60kg/ha+Sp3=40cm. Similar result were reported by Paun and Mihalea (1966) in chmamomile Emonger et al. (1989) observed that top dressing of nitrogen@ 50kg/ha produced best results on vegetative growth of chamomile plant. Shukla and Prasad 1998) obtained maximum plant height (63.4cm) when applied 60kg N/ha on chamomile plant Shenoy et al. (1993) observed maximum plant height in Devana with the application of N@120kg/ha, **Kapoor *et al.* (1963)** in chamomile. Similar results were reported by **Kanjilal *et al.* (2001). Sudhakar *et al.* (2002)** reported that S@ 60kg ha-1 significantly improved plant height.

The plant spreadof german chamomile as influenced by different levels of nitrogen, sulphur and spacing treatment combination. As a result of interaction between sulphur, nitrogen and spacing different levels of treatment combination the maximum plant spread (57.67) was obtained with treatment combination T_{27} N3=210kg/ha+S3=60kg/ha+Sp3=40cm followed by T_{26} N3=210kg/ha+S3 =60kg/ha+Sp2=30cm, T_{23} N2=180kg/ha+S3 =60kg/ha+Sp2 =30cm, T_{22} N2=180kg /ha + S3=60kg/ha + Sp1= 20cm, T_{25} N3=210kg /ha + S3=60kg/ha + Sp1= 20cm, and the minimum (41.073) remained with T_1N1=150kg /ha + S1=20kg/ha + Sp1= 20cm. The observation recorded in present findings are in line with earlier report of **Golze *et al.* (1970) and Enonger *et al.* (1989). Budzynski *et al.* (2001)** reported that supplementing with S has no effect on the stand it was increased the diameter of stem in mustard.

The number of branches per plant of german chamomile as influenced by different levels of nitrogen, sulphur and spacing treatment combination and As a result of interaction between sulphur, nitrogen and spacing different levels of treatment combination the maximum number of branches per plant (34.61) was obtained with treatment combination T_{27} N3=210kg/ha+S3=60kg/ha+Sp3= 40cm followed by T_{22} N2=180kg /ha + S3=60kg/ha + Sp1= 20cm, T_{25} N3=210kg /ha +

S3=60kg/ha + Sp1= 20cm, T_{17} N3=210kg/ha+S2= 40kg/ha+Sp2=30cm, T_7 N3=210kg /ha + S1=20kg/ha + Sp1= 20cm, T_{18} N3=210kg/ha+S2=40kg/ha+Sp3=40cm, T_8 N3= 210kg/ha+S1= 20kg/ha+Sp2= 30cm, T_{12} N1=150kg/ha+S2= 40kg/ha+Sp3 =40cm, and the minimum (22.47) remained with T_1N1=150kg /ha + S1=20kg/ha + Sp1= 20cm. In conformity to present findings **Johri *et al.* (1994), Shukla and Prasad (1998)** found (12.7) number of primary from higher level of nitrogen (90kg/ha) on this crop. Increase in the number of braches might be due to beter plant growth. This is also in line with finding of **Franz and Kirsch (1974), Gowda *et al.* (1991)** on German chamomile. **Om Prakash *et al.* (2002)** stated that highest number of branches per plant was increase in sulphur rate up to 40kg ha^{-1}.

Interaction Effect of Different Levels of sulphur, Nitrogen and Spacing on Number of Flower per plant, Total Number of Flower per Plot, Diameter of Flowers (cm) and Number of Days Taken to Appearance of Chamomile (*Matricaria chamomilla* l.).

The number of flower per plant of german chamomile as influenced by different levels of nitrogen, sulphur and spacing treatment combination. As a result of interaction between sulphur, nitrogen and spacing different levels of treatment combination the maximum number of flower per plant (50.60) was obtained with treatment combination T_{27} N3=210kg/ha+S3=60kg/ha+Sp3=40cm followed by T_{24} N2=180kg/ha+S3=60kg/ha+Sp3= 40cm, T_{26} N3=210kg/ha+S3 =60kg/ha+Sp2=30cm, T_{23} N2=180kg/ha+S3=60kg/ha+Sp2=30cm, T_{22} N2=180kg /ha + S3=60kg/ha + Sp1= 20cm and T_{25} N3=210kg /ha + S3=60kg/ha + Sp1= 20cm and the minimum (27.01) remained with T_1N1=150kg /ha + S1=20kg/ha + Sp1= 20cm. In conformity to present finding **Shenoy *et al.* (1993)** reported the effect of nitrogen in Devana and found that nitrogen application at 120 kg./ha. **Dutta and Singh (1964)** maximum yield per plant both as regards its weight and number of flowers however was obtained under the widert spacing of 45 x 45cm. Effect of NPK fertilization on chamomile was also observed by **El–Hamidii *et al.* (1965)** in Egypt. The observation recorded in present findings are in line with earlier report of **Piri *et al.* (2006).**

The Total number of flower per plot of german chamomile as influenced by different levels of nitrogen, sulphur and spacing treatment. As a result of interaction between sulphur, nitrogen and spacing different levels of treatment combination the maximum Total number of flower per plot (485.66) was obtained with treatment combination T_{27} N3=210kg/ha+S3= 60kg/ha+Sp3=40cm followed by T_{24} N2=180kg/ha+S3=60kg/ha+Sp3=40cm, T_{26} N3=210kg/ha+S3= 60kg/ha+Sp2=30cm, T_{23} N2=180kg/ha+S3 =60kg/ha+Sp2= 30cm, T_{22} N2=180kg /ha + S3=60kg/ha + Sp1= 20cm and T_{25} N3=210kg /ha + S3=60kg/ha + Sp1= 20cm and the minimum (336.66) remained with T_1N1=150kg /ha + S1=20kg/ha + Sp1= 20cm. In conformity to present finding **Shenoy *et al.* (1993)** reported the effect of nitrogen in Devana and found that nitrogen application at 120 kg./ha. **Dutta and Singh (1964)** maximum yield per plant both as regards its weight and number of flowers however was obtained under the widert spacing of 45 x 45cm. Effect of NPK fertilization on chamomile was also observed by **El–Hamidii *et al.* (1965)** in Egypt. The observation recorded in present findings are in line with earlier report of **Piri *et al.* (2006).**

The Diameter of flowers (cm) of german chamomile as influenced by different levels of nitrogen, sulphur and spacing treatment combination. As a result of interaction between sulphur, nitrogen and spacing different levels of treatment combination the maximum Diameter of flowers (cm) (2.397) was obtained with treatment combination T_{27} N3=210kg/ha+S3=60kg/ha+Sp3=40cm followed by T_{20} N1=150kg/ha+S3=60kg/ha+Sp2=30cm, T_{19} N1=150kg /ha + S3=60kg/ha + Sp1= 20cm, T_{23} N2=180kg/ha+S3=60kg/ha+Sp2=30cm, T_{25} N3=210kg /ha + S3=60kg/ha + Sp1= 20cm and T_{26} N3=210kg/ha+S3=60kg/ha+Sp2=30cm and the minimum (1.330) remained with T_1N1=150kg /ha + S1=20kg/ha +

Sp1= 20cm. In conformity to present finding **Shenoy *et al.* (1993)** reported the effect of nitrogen in Devana and found that nitrogen application at 120 kg./ha. **Dutta and Singh (1964)** maximum yield per plant both as regards its weight and number of flowers however was obtained under the widert spacing of 45 x 45cm. Effect of NPK fertilization on chamomile was also observed by **El–Hamidii *et al.* (1965)** in Egypt. The observation recorded in present findings are in line with earlier report of **Piri *et al.* (2006).**

The Number of days taken to appearance of german chamomile as influenced by different levels of nitrogen, sulphur and spacing treatment combination. As a result of interaction between sulphur, nitrogen and spacing different levels of treatment combination the minimum number of days taken to appearance (57.610) was obtained with treatment combination T_{27} N3=210kg/ha+S3 =60kg/ha+Sp3=40cm followed by T_{26} N3=210kg/ha+S3=60kg/ha+Sp2=30cm, T_{24} N2=180kg/ha+S3=60kg/ha+Sp3=40cm, T_{23} N2=180kg/ha+S3 =60kg/ha+Sp2 =30cm,T_{20} N1=150kg/ha+S3=60kg/ha+Sp2=30cm, T_{17} N3=210kg/ha+S2 =40kg/ha+Sp2=30cm, T_{21} N1=150kg/ha+S3 =60kg/ha+Sp3 =40cm and T_{14} N2=180kg/ha+S2=40kg/ha+Sp2=30cm and the maximum (61.563) remained with T_1N1=150kg /ha + S1=20kg/ha + Sp1= 20cm. It has also been exploited that more production of metabolites and photosynthesis is attributed to more induction of flower primordial and the development of flower head results to higher flower production **(Dutta and Singh, 1961; El. Hamidii *et al.*, 1955; Mishra, 1971; Dutta and Singh, 1964; Kapoor *et al.*, 1963; and Meawed *et al.*, (1984).**

Table 1: Effect of Different Levels of Sulphur, Nitrogen and Spacing on Plant Height (cm), Plant Spread and Number of Branches per Plant, of Chamomile (*Matricaria chamomilla* l.)

Treatment	Plant Height (cm)	Plant Spread	Number of Branches per Plant
N_1	72.638	43.182	27.059
N_2	79.609	47.436	26.642
N_3	83.088	54.134	28.828
F-test	S	S	S
S.Ed	0.188	1.65	0.23
C.D. at 0.5%	0.379	1.122	0.629
S_1	77.614	46.956	25.867
S_2	78.766	48.363	27.466
S_3	78.955	49.433	29.196
F-test	S	S	S
S.Ed	0.188	1.65	0.23
C.D. at 0.5%	0.379	1.122	0.629
Sp_1	78.242	47.429	26.737
Sp_2	78.344	47.763	27.770
Sp_3	78.749	49.561	28.021
F-test	S	S	S
S.Ed	0.188	1.65	0.23
C.D. at 0.5%	0.379	1.122	0.629

Table 2: Effect of Different Levels of Sulphur, Nitrogen and Spacing on Number of Flowers per Plant, Total Number of Flowers per plot, Diameter of Flowers (cm) and Number of Days Taken to Appearance of Chamomile (*Matricaria chamomilla* l.)

Treatment	Number of Flowers per Plant	Total Number of Flowers per Plot	Diameter of Flowers (cm)	Number of Days Taken to Appearance
N_1	34.685	367.296	1.524	61.075
N_2	37.273	414.037	1.839	59.673
N_3	40.464	475.519	2.086	58.219
F-test	S	S	S	S
S.Ed	0.20	2.30	0.031	0.113

Table 2: Contd.,				
C.D. at 0.5%	0.558	6.16	0.063	0.227
S_1	36.790	403.889	1.821	59.715
S_2	37.513	420.852	1.799	59.667
S_3	38.119	432.111	1.828	59.584
F-test	S	S	NS	S
S.Ed	0.20	2.30	0.031	0.113
C.D. at 0.5%	0.558	6.16	0.063	0.227
Sp_1	29.602	401.370	1.779	59.778
Sp_2	35.928	423.333	1.810	59.660
Sp_3	46.891	432.148	1.860	59.528
F-test	S	S	S	S
S.Ed	0.20	2.30	0.031	0.113
C.D. at 0.5%	0.558	6.16	0.063	0.227

Table 3: Interaction Effects of Different Levels of Sulphur, Nitrogen and Spacing on Plant Height (cm) Plant Spread and Number of Branches per Plant of Chamomile (*Matricaria chamomilla* l.)

Treatment No.	Treatment Details	Plant Height (cm)	Plant Spread	Number of Branches per Plant
T_1	N1=150kg /ha + S1=20kg/ha + Sp1= 20cm	71.450	41.073	22.477
T_2	N1=150kg/ha+S1=20kg/ha+Sp2=30cm	73.153	43.037	27.373
T_3	N1=150kg/ha+S1=20kg/ha+Sp3=40cm	71.903	43.327	26.403
T_4	N2=180kg /ha + S1=20kg/ha + Sp1= 20cm	72.263	42.213	27.287
T_5	N2=180kg/ha+S1=20kg/ha+Sp2=30cm	72.670	43.057	27.007
T_6	N2=180kg/ha+S1=20kg/ha+Sp3=40cm	72.087	44.433	29.420
T_7	N3=210kg /ha + S1=20kg/ha + Sp1= 20cm	73.593	41.930	29.080
T_8	N3=210kg/ha+S1=20kg/ha+Sp2=30cm	73.223	43.583	27.500
T_9	N3=210kg/ha+S1=20kg/ha+Sp3=40cm	73.397	45.983	26.983
T_{10}	N1=150kg /ha + S2=40kg/ha + Sp1= 20cm	76.907	45.280	27.037
T_{11}	N1=150kg/ha+S2=40kg/ha+Sp2=30cm	78.450	46.307	25.657
T_{12}	N1=150kg/ha+S2=40kg/ha+Sp3=40cm	78.590	47.410	27.737
T_{13}	N2=180kg /ha + S2=40kg/ha + Sp1= 20cm	80.010	48.427	26.860
T_{14}	N2=180kg/ha+S2=40kg/ha+Sp2=30cm	78.970	46.463	27.807
T_{15}	N2=180kg/ha+S2=40kg/ha+Sp3=40cm	80.913	48.290	25.257
T_{16}	N3=210kg /ha + S2=40kg/ha + Sp1= 20cm	80.550	46.500	23.113
T_{17}	N3=210kg/ha+S2=40kg/ha+Sp2=30cm	79.770	47.297	29.507
T_{18}	N3=210kg/ha+S2=40kg/ha+Sp3=40cm	82.320	50.950	26.803
T_{19}	N1=150kg /ha + S3=60kg/ha + Sp1= 20cm	81.481	51.560	23.683
T_{20}	N1=150kg/ha+S3=60kg/ha+Sp2=30cm	82.850	49.790	28.453
T_{21}	N1=150kg/ha+S3=60kg/ha+Sp3=40cm	83.743	54.820	23.980
T_{22}	N2=180kg /ha + S3=60kg/ha + Sp1= 20cm	83.270	54.830	31.033
T_{23}	N2=180kg/ha+S3=60kg/ha+Sp2=30cm	82.110	54.393	27.793
T_{24}	N2=180kg/ha+S3=60kg/ha+Sp3=40cm	82.363	53.160	24.730
T_{25}	N3=210kg /ha + S3=60kg/ha + Sp1= 20cm	83.903	55.043	30.067
T_{26}	N3=210kg/ha+S3=60kg/ha+Sp2=30cm	83.420	55.937	31.093
T_{27}	N3=210kg/ha+S3=60kg/ha+Sp3=40cm	84.653	57.673	34.617
F-test		S	S	S
S.Ed		0.377	3.26	0.47
CD at 0.5%		1.138	3.366	1.88

Table 4: Interaction Effect of Different Levels of Sulphur, Nitrogen and Spacing on Number of Flowers per Plant, Total Number of Flowers per Plot, Diameter of Flowers (cm) and Number of Days Taken to Appearance of Chamomile (*Matricaria chamomilla* l.)

Treatment No.	Treatment Details	Number of Flowers per Plant	Total Number of flowers per Plot	Diameter of Flowers (cm)	Number of Days Taken to Appearance
T_1	N1=150kg /ha + S1=20kg/ha + Sp1= 20cm	27.012	336.667	1.330	61.563
T_2	N1=150kg/ha+S1=20kg/ha+Sp2=30cm	31.927	347.000	1.380	59.780
T_3	N1=150kg/ha+S1=20kg/ha+Sp3=40cm	43.657	386.000	1.463	59.960
T_4	N2=180kg /ha + S1=20kg/ha + Sp1= 20cm	26.296	326.667	1.580	61.530
T_5	N2=180kg/ha+S1=20kg/ha+Sp2=30cm	33.603	373.333	1.447	60.580
T_6	N2=180kg/ha+S1=20kg/ha+Sp3=40cm	42.889	376.667	1.613	62.012
T_7	N3=210kg /ha + S1=20kg/ha + Sp1= 20cm	29.089	386.333	1.613	61.181
T_8	N3=210kg/ha+S1=20kg/ha+Sp2=30cm	34.223	389.000	1.613	57.963
T_9	N3=210kg/ha+S1=20kg/ha+Sp3=40cm	43.466	384.000	1.680	61.160
T_{10}	N1=150kg /ha + S2=40kg/ha + Sp1= 20cm	28.408	370.667	1.950	59.730
T_{11}	N1=150kg/ha+S2=40kg/ha+Sp2=30cm	35.036	406.667	1.880	59.563
T_{12}	N1=150kg/ha+S2=40kg/ha+Sp3=40cm	47.693	444.667	1.630	59.880
T_{13}	N2=180kg /ha + S2=40kg/ha + Sp1= 20cm	28.408	376.667	1.897	59.800
T_{14}	N2=180kg/ha+S2=40kg/ha+Sp2=30cm	36.250	430.000	1.750	59.330
T_{15}	N2=180kg/ha+S2=40kg/ha+Sp3=40cm	46.152	423.000	1.750	60.197
T_{16}	N3=210kg /ha + S2=40kg/ha + Sp1= 20cm	29.760	403.667	1.930	58.780
T_{17}	N3=210kg/ha+S2=40kg/ha+Sp2=30cm	36.450	435.000	1.980	60.460
T_{18}	N3=210kg/ha+S2=40kg/ha+Sp3=40cm	47.306	436.000	1.780	59.313
T_{19}	N1=150kg /ha + S3=60kg/ha + Sp1= 20cm	31.284	438.000	2.163	59.380
T_{20}	N1=150kg/ha+S3=60kg/ha+Sp2=30cm	37.243	447.333	2.197	58.680
T_{21}	N1=150kg/ha+S3=60kg/ha+Sp3=40cm	48.853	458.000	2.130	58.897
T_{22}	N2=180kg /ha + S3=60kg/ha + Sp1= 20cm	33.603	496.667	1.697	61.910
T_{23}	N2=180kg/ha+S3=60kg/ha+Sp2=30cm	39.019	489.333	2.030	57.983
T_{24}	N2=180kg/ha+S3=60kg/ha+Sp3=40cm	51.400	495.333	1.997	57.930
T_{25}	N3=210kg /ha + S3=60kg/ha + Sp1= 20cm	32.563	477.000	2.147	57.913
T_{26}	N3=210kg/ha+S3=60kg/ha+Sp2=30cm	39.605	492.333	2.013	57.610
T_{27}	N3=210kg/ha+S3=60kg/ha+Sp3=40cm	50.607	485.667	2.397	57.610
F-test		S	S	S	S
S.Ed		0.41	4.61	0.062	0.226
CD at 0.5%		1.674	18.49	0.189	0.682

CONCLUSIONS

Concluded from the present findings that the application of 27, Interaction treatment effect with levels of nitrogen (150kg/ha, 180kg/ha and 210kg/ha), Sulphur (20kg/ha, 40kg/ha and 60kg/ha) and three spacing (20cm, 30cm and 40cm). The treatment T_{27} N3 = 210 kg / ha + S3 = 60kg / ha + Sp3 = 40 cm showed significant response in increasing that all plant growth i.e plant height (cm), plant spread (cm), number of branches per plant, number of flower per plant, Total number of flower per plot, Diameter of flowers (cm) and Number of days taken to appearance.

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